Effect of maternal health education on physical activity and body mass index of overweight children

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Effect of maternal health education on physical activity and body mass index of overweight children

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Abstract

Background The percentage of overweight children in Bengkulu (16.4%) is higher than the national percentage (11.9%). High energy intake and low physical activity are two factors that cause overweight.

Objective To assess the impact of maternal health education on changes in maternal behavior, as well as energy intake, physical activity level, and body mass index (BMI) z-scores in overweight children aged 3-6 years.

Methods This study was a quasi-experiment with non-randomized, pre-post test control group, conducted in Bengkulu, Indonesia from January to April 2014. Subjects consisted of 48 mothers with overweight children, who were selected purposively and divided into 2 groups (treatment and control). Subjects' parents kept records of their children's food intake and daily activity. These records were used to measure energy intake and physical activity. Health education in the treatment group was conducted 6 times in 12 weeks, while the control group received health education only once at the beginning of the study.

Results In the treatment group, the child physical activity level [0.04 (SD 0.01)] increased, while the % RDA for energy [-3.4 (SD 13.26)%] and BMI z-score [-0.57 (SD 0.26)] decreased. Significant differences were observed between the treatment and control groups in terms of maternal attitude, and children's % RDA for energy, physical activity level, and BMI z-score after intervention ($P < 0.05$).

Conclusion Health education for mothers effects a positive change in maternal attitude, as well as increased physical activity level, decreased energy consumption relative to their need, and BMI z-score in overweight children. **[Paediatr Indones. 2016;56:73-8.]**

Keywords: *body mass index, overweight, physical activity*

Excess weight, comprising of overweight and obesity, is a term used to describe excess body fat.[1,2] The preschool period (age 3-6 years) is a crucial time for contributing to an overweight condition in the adult life. In the first year of life, the body mass index (BMI) increases considerably, as babies have a large amount of adipose cells. These cells are retained from the age of 3 to 6 years, but increase again after this age, a phenomenon known as adipose rebound. Early adipose rebound, occurring at the age of 3 to 6 years, leads to overweight while growing up.[3]

The percentage of children with excess body weight in the world has increased from 4.2% in 1990 to 6.7% in 2010, and is estimated to reach 9.1% in 2020.[4] In Bengkulu, this percentage rose from 15.5% in 2010 to 16.4% in 2013, and was above the national percentage of 11.9%.[5,6] The main causes of childhood excess weight are a high energy intake, along with a lack of physical activity.[7,8] Energy intake is one side of the energy balance,

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hence, overconsumption of food is a clear risk factor for overweight.[9] Increasing physical activity also plays a key role in the treatment of overweight individuals.[10,11] Prevention and control of childhood excess weight requires various programs and policies, and most importantly, parental participation.[12] One way to manage childhood excess weight is by providing health education for parents.[13-15] Health education is a structured process given as a fundamental behavioral intervention aimed at influencing one's knowledge, attitude, and behavior to promote good health.[16,17] Parental education on nutrition promotes a positive behavioral change in improving children's food intake.[18] Parents can provide healthy food and support their children's physical activity.[19] Parents, especially mothers, have a crucial social influence in the food choices made by their children.[7] Children generally copy their parents' diet and act submissively in accepting the dishes served to them.[20]

We aimed to determine the impact of maternal health education on mothers' attitude and behavior as well as the energy intake, physical activity, and BMI z-score in overweight children aged 3-6 years. Variables were maternal educational level, maternal attitude and behavior, and children's nutritional intake (intake percentages of carbohydrate, fat, saturated fat, and unsaturated fat, as well as level of protein adequacy and fiber intake), intensity of physical activity, and BMI z-score. Maternal age, educational level, and other media interventions were confounding variables. The study outcome was expected to be a basis for a guideline for managing childhood obesity.

Methods

This quasi-experimental study with a non-randomized pre-post test control group was done from January to April 2014. The treatment subjects were from a playgroup and preschool education center *Pendidikan Anak Usia Dini Islam Terpadu/PAUD* (Integrated Islamic Playgroup) ´"Auladuna". The control subjects were from an integrated Islamic preschool *(Taman Kanak-kanak Islam Terpadu/TKIT*) in Rabbani Bengkulu, Indonesia.

The subjects were mothers and overweight children aged 3-6 years. Children's weight status was determined by their BMI z-scores. Children with chronic conditions and/or congenital defects were excluded. Subjects consisted of 48 mother-child pairs who were included by purposive sampling and assigned to one of the two groups (treatment or control). The minimum required sample size was calculated using a level of error (α) = 5%, power test=90%, and standard deviation derived from the study by Sanigorski *et al*.[21] at 0.04 with a 10% anticipated drop-out rate, resulting a minimum sample size of 24 mother-child pairs per group.

Subjects' identity, level of mother's knowledge including from social media, attitude, behavior, and other were acquired from interviews using a structured questionnaire. Nutritional intake data were collected using food record forms for 2 non-consecutive days within a week. Physical activity level was acquired from a personal recording of daily activity using physical activity forms for 7x24 hours, based on the Compendium of Energy Expenditures for Youth.[22] The BMI z-scores were acquired from weight and height measurements and processed using *WHO Anthro* software. Mothers in the treatment group received health education 6 times for 12 weeks (60 minutes per class period), using a participation discussion method and booklets containing practical guides on childhood obesity management. Mothers in the control group received health education only once for 60 minutes at the beginning of the study. Data were analyzed using paired T-test and independent T-test. Covariance test was done to evaluate the effectiveness of the given intervention. This study was approved by the Research Ethics Committee, Diponegoro University Medical School, Semarang.

Results

Subjects were 48 mother-child pairs. Mothers were aged 27-37 years and children were aged 3-6 years. **Table 1** shows that maternal age, educational level, and other media interventions were similar in the two groups ($P > 0.05$).

Table 2 shows the maternal level of knowledge, attitude, and behavior, as well as children's nutritional intake, physical activity level, and BMI z-score in the

Table 1. Demographic characteristic of subjects at the beginning of the study

Characteristics	Treatment group		Control group		P value
	Range	Mean (SD)	Range	Mean (SD)	
Maternal age, years	27-36	30.9 (2.72)	27-37	31.0 (2.62)	0.872[a]
Maternal educational level, years	15-18	16.0 (0.55)	12-18	16.0 (0.96)	0.962[b]
Other media interventions	1.0-2.0	1.0 (0.38)	1.0-2.0	1.0 (0.33)	0.686[b]

[a] Independent T-test; [b]Mann-Whitney

Table 2. Differences in maternal and children's variables before and after the 12–week intervention

Variables	Treatment group (n=24)		Control group (n=24)		P value
	Range	Mean (SD)	Range	Mean (SD)	
Mothers'					
Level of knowledge					
Before intervention	53.85-84.62	67.3 (8.25)	53.85-84.62	69.2 (8.85)	0.117[b]
After intervention	85.62-100.0	100 (5.07)	61.54-84.62	73.0 (8.48)	0.001[b]
P value		0.001[d]		0.148[d]	
Attitude					
Before intervention	65.0-77.5	72.5 (3.44)	65.0-75.0	71.2 (3.29)	0.791[b]
After intervention	87.5-97.5	92.5 (3.03)	60.0-77.5	72.5 (4.85)	0.001[b]
P value		0.001[d]		0.204[d]	
Behavior					
Before intervention	57.5-77.5	64.3 (2.97)	60.0-70.0	65.0 (2.75)	0.142[b]
After intervention	87.5-97.5	92.5 (3.03)	62.5-70.0	67.5 (2.44)	0.001[b]
P value		0.001[c]		0.216[d]	0.216[d]
Children's					
% RDA for energy					
Before intervention	101.4-158.5	112.8 (14.28)	95.1-128.3	114.0 (9.3)	0.951[b]
After intervention	95.1-124.6	108.0 (7.31)	101.4-158.5	119.0 (13.19)	0.001[b]
P value		0.001[d]		0.045[d]	
% carbohydrate intake					
Before intervention	37.8-60.5	50.6 (5.41)	41.4-68.9	54.0 (6.4)	0.053[a]
After intervention	46.6-65.9	54.3 (4.05)	42.4-71.5	50.7 (6.34)	0.014[b]
P value		0.022[c]		0.230[d]	
% fat intake					
Before intervention	21.5-44.6	32.9 (5.1)	20.2-44.1	31.2 (5.94)	0.285[a]
After intervention	20.2-38.1	30.5 (4.97)	19.2-42.3	32.0 (5.23)	0.302[b]
P value		0.085[c]		0.637[c]	
% saturated fat intake					
Before intervention	31.9-52.3	41.1 (5.77)	19.2-49.6	40.5 (6.47)	0.853[b]
After intervention	31.2-43.4	35.7 (3.23)	34.2-58.1	45.0 (6.33)	0.001[a]
P value		0.001[c]		0.016[d]	
% RDA for protein					
Before intervention	89.1-220.7	138.1 (31.75)	106.4-159.4	131.4 (16.41)	0.366[a]
After intervention	100.1-138.4	17.1 (9.75)	89.1-220.7	138.1 (33.30)	0.006[a]
P value		0.009[c]		0.418[c]	
Fiber intake					
Before intervention	6.6-12.6	9.3 (1.8)	6.3-12.2	9.1 (1.3)	0.591[a]
After intervention	9.5-15.2	12.3 (1.81)	7.4-12.6	9.9 (1.73)	0.001[a]
P value		0.001[c]		0.077[c]	
Physical activity level					
Before intervention	1.31-1.66	1.40 (0.09)	1.31-1.69	1.47 (0.09)	0.779[a]
After intervention	1.35-1.69	1.50 (0.09)	1.30-1.68	1.40 (0.94)	0.017[a]
P value		0.01[c]		0.001[c]	
BMI z-score					
Before intervention	2.45-3.58	2.90 (0.29)	2.36-3.23	2.79 (0.18)	0.152[a]
After intervention	1.99-2.91	2.32 (0.28)	2.32-3.18	2.84 (0.18)	0.001[a]
P value		0.001[c]		0.001[c]	

[a] Independent T-test; [b] Mann-Whitney; [c] paired T-test; [d] Wilcoxon; RDA=recommended dietary allowance

treatment and control groups. Prior to the intervention, these variables were not significantly different between groups (P>0.05). However, upon the completion of the 12-week intervention, significant differences were observed between the 2 groups in terms of maternal level of health education including knowledge, attitude, and behavior, as well as children's percentage of recommended dietary allowances (% RDA) for energy, percentages of carbohydrate, saturated fat, and unsaturated fat intake, % RDA for protein, fiber intake, and physical activity level. Similarly, within the treatment group, significant differences before and after the 12-week intervention were observed in all variables except for % fat intake.

Table 3 shows that differences in the score changes between treatment and control groups were statistically significant for maternal level of knowledge, attitude, and behavior, as well as in children's % RDA for energy, percentages of saturated fat intake and unsaturated fat intake, % RDA for protein, physical activity level, and BMI z-scores in the treatment group compared to the control group (P< 0.05).

The effectiveness of the given treatment, in which the treatment group was expected to show changes after intervention compared to the control group, was analyzed using the covariance test. Variables eligible for covariance test analysis were maternal attitude, children's % RDA for energy, % of carbohydrate intake, level of physical activity, and BMI z-score. **Table 4** shows significant differences in the end results between the treatment and control groups after intervention for maternal attitude, children's % RDA for energy, level of physical activity, and BMI z-score (P< 0.05).

Table 3. Score changes in maternal and children's variables in the treatment and control groups

Variables	Treatment group		Control group		P value
	Range	Mean (SD)	Range	Mean (SD)	
Mothers'					
Δ educational level	3.8-84.6	67.3 (8.25)	-23.1-23.1	2.8 (11.02)	0.001[a]
Δ attitude	12.5-30.0	20.9 (3.52)	-15.0-10.0	2.5 (5.61)	0.001[b]
Δ behavior	-5.0-30	9.7 (10.59)	-5.0-5.0	0.0 (3.08)	0.001[b]
Children's					
Δ RDA for energy	-45.9-4.0	-3.4 (13.26)	-2.6-49.9	1.4 (13.23)	0.001[b]
Δ % carbohydrate intake	-10.2-21.2	3.6 (7.30)	-21.7-23.6	0.1 (10.67)	0.196[a]
Δ % fat intake	-17.1-9.4	-2.4 (6.67)	-13.5-13.9	0.7 (8.09)	0.138[a]
Δ % saturated fat intake	-17.3-3.8	-5.2 (5.51)	-10.1-23.0	4.6 (8.97)	0.001[a]
Δ % unsaturated fat intake	-4.2-19.2	6.6 (5.60)	-18.6-7.9	-1.1 (8.02)	0.001[a]
Δ % RDA for protein	-102.3-39.1	-22.8 (34.51)	-64.9-88.2	7.2 (39.68)	0.007[a]
Δ fiber intake	-7.6-5.3	-0.1 (3.09)	-5.1-7.6	1.1 (3.58)	0.191[a]
Δ physical activity level	0.01-0.07	0.04 (0.01)	-0.05-0.03	-0.01 (0.01)	0.001[b]
Δ BMI z-score	-1.51- -0.05	-0.57 (0.26)	-0.05-0.18	0.05 (0.06)	0.001[b]

[a] Independent T-test; [b] Mann-Whitney; [c] paired T-test; [d] Wilcoxon; Δ=differences between pre and post intervention

Table 4. Covarian model analysis

Variables	Groups		F	P value£	*Partial Eta squared*
	Treatment (n=24)	Control (n=24)			
Mothers' Mean attittude (SD)	92.5 (3.03)	72.1 (4.85)	306.374	0.001	0.872
Children's					
Mean % RDA for energy (SD)	108.1 (7.30)	119.1 (13.2)	15.580	0.001	0.257
Mean % carbohydrate intake (SD)	54.3 (4.05)	51.4 (6.34)	1.714	0.197	0.037
Mean physical activity level (SD)	1.5 (0.09)	1.4 (0.09)	200.091	0.001	0.816
Mean BMI z-score (SD)	2.32 (0.28)	2.84 (0.18)	132.393	0.001	0.746

£General linear model analysis controlled by baseline data variables

Discussion

A positive change in maternal attitude towards management of childhood excess weight was observed in the treatment group, but not in the control group, after educational intervention. Attitude is one of the steps to achieve behavioral changes, as having a positive attitude change increases the likelihood of a behavioral change.[23]

A fundamental cause for excess body weight is energy imbalance between consumed calories on one side and calorie expenditure on the other side.[24] After intervention, the control group had significantly higher % RDA for energy than the treatment group, indicating that health education for mothers may have helped lower the children's level of energy consumption relative to need in the treatment group. Similarly, other studies suggest that health education for parents may lower children's energy intake.[19,25]

Physical activity is a key determinant in energy expenditure, resulting in the basis for energy balance and body weight control.[26] Upon the completion of intervention, we observed a higher mean physical activity level in the treatment group than in the control group, suggesting that health education for mothers may have influenced the increase in children's physical activity. The result is comparable to another study that demonstrated a significant influence of educational intervention on increased physical activity in children.[3] One study on physical activity of overweight and non-overweight preschool children found a significant association between the lack of physical activity and childhood excess weight. In addition, families with overweight children tended to have televisions in their children's rooms.[27]

The international classification for the degree of excess body weight is based on the body mass index (BMI).[7] The BMI has been frequently used to evaluate nutritional status due to its simplicity of measurement and be its correlation with body fat.[28] The BMI varies according to age and sex,[9] and classification of children's nutritional status is determined using BMI z-scores, based on age and sex.[29] We found a significantly higher BMI z-score in the control group compared to the treatment group, after the 12-week intervention, suggesting that maternal health education may lower children's BMI z-score. Previous interventional studies have also suggested that parental health education may lower children's BMI z-scores.[30-33]

In conclusion, maternal health education may effect a positive attitude change in mothers for managing childhood excess weight, improving physical activity, and lowering the level of energy adequacy and BMI z-scores in children with excess weight. Therefore, the management of childhood excess weight for 3-6-year-olds may best be done by implementing health education for mothers on healthy diets and increasing children's physical activity. Further studies are needed using a survey method for food consumption with a minimum information bias.

Conflict of interest

None declared.

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